Listing of the Claims

1. (Previously Presented) A method for simulating a real-time rendering of a desired graphical effect in an image of an object on a display, in regard to a single static viewpoint, comprising the steps of:

(a) precomputing data defining a behavior of light rays illuminating the object in regard to the single static viewpoint, based on a plurality of input images, to produce a plurality of morph maps for the object in which at least one set of pixel-dependent data is associated with each pixel position on the display;

(b) in response to one of a user action and an event that indicates the desired graphical effect, performing a transformation two-dimensionally using the plurality of morph maps to produce an output image that simulates the real-time rendering of the desired graphical effect; and

(c) displaying the output image.

2. (Original) The method of Claim 1, wherein the step of precomputing comprises the step of producing data that include a blending factor.

3. (Original) The method of Claim 1, wherein the step of precomputing comprises the step of producing data that include an additive factor that is used to control saturation of the output image.

4. (Original) The method of Claim 1, wherein the step of precomputing comprises the step of tracing rays of light to determine the plurality of morph maps based on a global illumination and a local illumination at each intersection of the rays of light with a surface.

5. (Original) The method of Claim 1, wherein the step of performing the transformation comprises the steps of:

(a) producing a plurality of warped images from the plurality of morph maps; and

(b) combining the plurality of warped images over a range, with a cross-dissolve, to produce successive output images in which the object morphs between an initial state and a final state.

6. (Original) The method of Claim 1, wherein the step of performing the transformation comprises the step of mapping a selected portion of a surface of the object onto a different part of the object to simulate an effect corresponding to movement of the selected portion of the surface over the object.

7. (Original) The method of Claim 6, wherein only pixels of the object that have been altered during the transformation to implement the effect are recomputed in the output image.

LAW OFFICES OF RONALD M. ANDERSON
600 - 108th Avenue N.E., Suite 507
Bellevue, Washington 98004
Telephone: (425) 688-8816 Fax: (425) 646-6314

8. (Original) The method of Claim 6, wherein the step of performing the transformation comprises the steps of:

(a) providing a grid of cells that overlies and bounds pixels in the selected portion of the surface of the object in the output image;

(b) for each cell of the grid, associating an arbitrary rectangle having an area that bounds all samples in an original image affected by the pixels in the cell of the output image; and

(c) determining a union of all rectangles that are associated with the cells of the grid that intersect the area of the arbitrary rectangle, to produce the output image.

9. (Original) The method of Claim 8, further comprising the step of using an index to map between a region in an input image and a corresponding region in the output image, to determine which portion of one of the input image and the output image is changed if a portion of the other of the input image and the output image has changed.

10. (Original) The method of Claim 1, wherein the transformation to achieve the desired effect comprises one of the steps of:

(a) mapping a texture onto the object in the output image;

(b) applying a reflection to the object in the output image; and

(c) applying a refraction of the object in the output image.

11. (Original) The method of Claim 1, wherein the step of precomputing includes the step of storing anti-aliasing data for use in producing the output image.

12. (Original) The method of Claim 1, wherein the step of precomputing is based on one of a three-dimensional geometry of the input images and a set of properties of a material in the input images.

13. (Original) The method of Claim 1, wherein the data produced in the step of precomputing includes a lookup table in which parameters used in producing the output image are stored.

14. (Original) A computer-readable medium having computer-executable instructions for performing the steps recited in Claim 1.

15. (Original) A computer-readable medium having computer-executable instructions for performing steps (b) and (c) in Claim 1.

///

LAW OFFICES OF RONALD M. ANDERSON
600 - 108th Avenue N.E., Suite 507
Bellevue, Washington 98004
Telephone: (425) 688-8816 Fax: (425) 646-6314

16. (Previously Presented) A method for simulating rendering of graphical effects in an image displayed in real time, comprising the steps of:

(a) precomputing a plurality of morph maps of a displayed scene in regard to a single static viewpoint, said plurality of morph maps being blendable and including anti-aliasing information and data for each of a plurality of pixels in a defined area;

(b) storing the morph maps for subsequent use in simulating rendering of a selected effect associated with the defined area;

(c) transforming at least one input image two-dimensionally using a blending of the plurality of morph maps to produce the selected effect in an output image; and

(d) displaying the output image, simulating the real-time rendering of the selected effect in the output image.

17. (Original) The method of Claim 16, wherein the selected effect comprises at least one of the steps of:

(a) anti-aliasing to smooth edges in the output image;

(b) displaying light refraction in the output image;

(c) displaying light reflection in the output image;

(d) morphing between an object in the displayed scene and a substantially altered object in a final output image over a defined range of intermediate images, starting with the input image; and

(e) dynamically warping a selected portion of an object over a different portion of an object in the output image.

18. (Original) The method of Claim 16, wherein for each pixel in the defined area, the data comprising each of the plurality of morph maps includes at least a subset of the following parameters:

(a) an index that identifies a pixel data set from among a plurality of pixel data sets in the morph map;

(b) an image identifier that, as a function of its value, indicates one of:

(i) the input image from among a plurality of input images, in which the defined area appears; and

(ii) a constant color that is to be applied to the pixel;

(c) coordinates of the pixel in the input image;

LAW OFFICES OF RONALD M. ANDERSON
600 - 108th Avenue N.E., Suite 507
Bellevue, Washington 98004
Telephone: (425) 688-8816 Fax: (425) 646-6314

(d) the constant color that is to be applied to the pixel, dependent upon the value of the image identifier;

(e) a multiplicative coeponent applied to modulate an appearance of the pixel;

(f) an additive factor used to shift the appearance of the pixel with a color saturation; and

(g) a blending factor applicable to the additive factor.

19. (Original) The method of Claim 16, wherein the step of precomputing comprises the step of computing the plurality of morph maps with a light simulating algorithm that determines a local illumination and a global illumination at each point where a light ray intersects a surface in the input image.

20. (Original) The method of Claim 16, wherein the effect comprises the rendering of a textured patch on a surface of an object as the patch is dragged over the surface by a user, further comprising the step of indexing pixels on the input image to corresponding pixels in the output image in which the patch is illustrated as it is dragged.

21. (Original) The method of Claim 16, wherein the effect comprises the rendering of an object simulating a refraction that occurs as light reflected from the object passes through a non-homogeneous medium that is at least partially transparent.

22. (Original) The method of Claim 16, wherein only pixels in the input image that have changed are transformed to produce the output image.

23. (Original) The method of Claim 22, further comprising the step of bi-directionally mapping between each of a plurality of pixels in a selected region of the input image and a corresponding pixel in a corresponding region of the output image, to define the pixels that have changed in the input image when producing the output image.

24. (Previously Presented) A system for simulating a real-time rendering of a desired graphical effect in an image of an object on a display in regard to a specific viewpoint that remains static, comprising:

(a) a display on which images are displayable;

(b) a memory in which a plurality of machine instruction are stored; and

(c) a processor coupled to the display and to the memory, said processor executing the plurality of machine instructions to carry out a plurality of functions, including:

LAW OFFICES OF RONALD M. ANDERSON
600 - 108th Avenue N.E., Suite 507
Bellevue, Washington 98004
Telephone: (425) 688-8816 Fax: (425) 646-6314

(i) precomputing data defining a behavior of light rays illuminating the object based on a plurality of input images, producing a plurality of morph maps in which at least one set of pixel-dependent data is associated with each pixel position, said data including anti-aliasing information, said plurality of morph maps being stored in the memory;

(ii) in response to one of a user action and an event that indicates the desired graphical effect, performing a transformation two-dimensionally using the plurality of morph maps to produce an output image that simulates the real-time rendering of the desired graphical effect; and

(iii) displaying the output image on the display.

25. (Original) The system of Claim 24, wherein the data produced by precomputing include a blending factor.

26. (Original) The system of Claim 24, wherein the data produced by precomputing include an additive factor that is used to control a color saturation in the output image.

27. (Original) The system of Claim 24, wherein when precomputing, the processor traces rays of light to determine the plurality of morph maps based on a global illumination and a local illumination at each intersection of the rays of light with a surface in at least one of the input images.

28. (Original) The system of Claim 24, wherein when performing the transformation, the processor:

(a) produces a plurality of warped images from the plurality of morph maps; and

(b) combines the plurality of warped images with a cross-dissolve over a range to produce successive output images in which the object morphs between an initial state and a final state.

29. (Original) The system of Claim 24, wherein when performing the transformation, the processor maps a selected portion of a surface of the object onto a different part of the object to simulate an effect corresponding to movement of the selected portion of the surface over the object.

30. (Original) The system of Claim 29, wherein only pixels of the object that have been altered are recomputed by the processor in the output image.

31. (Original) The system of Claim 29, wherein when performing the transformation, the processor:

///

LAW OFFICES OF RONALD M. ANDERSON
600 - 108th Avenue N.E., Suite 507
Bellevue, Washington 98004
Telephone: (425) 688-8816 Fax: (425) 646-6314

(a) provides a grid of cells that overlies and bounds pixels in the selected portion of the surface of the object in the output image;

(b) for each cell of the grid, associates an arbitrary rectangle having an area that bounds all samples in an original image affected by the pixels in the cell of the output image; and

(c) determines a union of all rectangles that are associated with the cells of the grid that intersect the area of the arbitrary rectangle, to produce the output image.

32. (Original) The system of Claim 31, wherein execution of the machine instructions causes the processor to produce an index to map between a region in an input image and a corresponding region in the output image, said index being used by the processor to determine which portion of one of the input image and the output image should be changed if a portion of the other of the input image and output image has changed.

33. (Original) The system of Claim 24, wherein the transformation to achieve the desired effect comprises one of:

(a) mapping a texture onto the object in the output image;

(b) applying a reflection to the object in the output image; and

(c) applying a refraction of the object in the output image.

34. (Original) The system of Claim 24, wherein when precomputing, the processor stores anti-aliasing data in the memory for use in producing the output image.

35. (Original) The system of Claim 24, wherein the precomputing employs at least one of a three-dimensional geometry of the input images, and a set of properties of a material in the input images.

36. (Original) The system of Claim 24, wherein the data produced when precomputing includes a lookup table in which parameters used in producing the output image are stored in the memory.

///

///

///

///

///

///

LAW OFFICES OF RONALD M. ANDERSON
600 - 108th Avenue N.E., Suite 507
Bellevue, Washington 98004
Telephone: (425) 688-8816 Fax: (425) 646-6314